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near the center. Well-developed colonies are translucent and yellowish under the microscope by transmitted light. Colonies not crowded may reach 3 mm. in diameter before ceasing to increase. In bouillon a marked growth is visible after eighteen hours, without pellicle or clouding, the sedimenting white growth clinging to the sides of the tube. After ten or fifteen days the brown pigment makes its appearance, diffusing throughout the medium and the sediment takes on a dirty-brownish color. Gelatine is liquefied, the liquefaction in tubes at first crateriform or funneliform, but may become stratiform, reaching the walls of the tube and extending down horizontally. Occasionally the lower end of the stab liquefies the faster and produces a terminal sac of liquefaction. Blood serum is liquefied, with production after three or four days of the brown color, which becomes much darker with age than in old agar cultures. On ordinary acid potato no growth occurs. On neutral potato a very scanty growth takes place, becoming visible about the third day, not increasing after four or five days and never producing color. It grows abundantly in neutral milk, without coagulation, reaction unchanged or becoming slightly acid, the milk peptonizing and becoming nearly clear in from one to two weeks.

The optimum temperature is not far from 20°C. In the refrigerator between 3° and 6°C., no visible growth occurs, but the organism is not injured. A temperature of 31°C. inhibits somewhat the growth and of 37.5°C. arrests it entirely and the organism is killed by an exposure to it of seventeen hours. Bouillon cultures are sterilized by an exposure to 42°C. for ten minutes. A culture on a sealed agar slant was still alive at the end of seven months. The rate of growth and chromogenic property were markedly inhibited, but both were restored by repeated transfers.

In vacuo, by exhaustion with a Chapman pump and absorption of oxygen by pyrogallic acid and caustic potash a slight multiplication occurs, apparently due to a trace of oxygen at the beginning of the experiment. The growth does not increase and the organism is probably an obligate aerobe. It does not fer-

ment glucose, lactose or saccharose, and does not produce indol, phenol, ammonia (in bouillon), invertin or diastatic ferments. It reduces nitrates to nitrites and finally to ammonia. Cultures in one per cent. glucose bouillon acquire an acidity or increase of acidity of 1.2 per cent to 1.6 per cent. in fifteen days, without production of the brown color; while in lactose or saccharose bouillon a very slight or no development of acidity occurs, and the pigment is produced much as in plain bouillon.

It is pathogenic particularly to the brook trout (*Salvelinus fontinalis*) and has been isolated from the Loch Leven (*Salmo trutta levenensis*) in epidemic, and in a few cases from the lake trout (*Cristivomer namaycush*). It has been found only in domesticated or aquarium fish and never in wild trout from the natural waters. It is not pathogenic to warm-blooded animals, and trout dead of the disease may be eaten after cooking, without harm.

After several months and repeated transfers on artificial media, it may slightly cloud bouillon, and exhibit a more pronounced Brownian movement to a degree suggesting motility. Attempts to stain flagella have had negative results, and the species is placed in *Bacterium* and named *truttae* for the group of fishes that apparently contains its chief hosts.

M. C. MARSH.

U. S. FISH COMMISSION.

DISCOVERY OF A MUSK OX SKULL (OVIBOS CAVIFRONS LEIDY), IN WEST VIRGINIA, NEAR STEUBENVILLE, OHIO.

At the fifty-first meeting of the American Association for the Advancement of Science, held in Pittsburgh, June 28 to July 23, 1902, Mr. Sam Huston exhibited a portion of the skull of a musk ox recently found near Steubenville, Ohio, at the same time making a verbal communication relative to the discovery of the specimen. Mr. Huston has lately sent to the writer for publication the following account of the finding of this skull, together with the accompanying sketch of a cross-section of the Ohio River valley at the point where the skull was found:

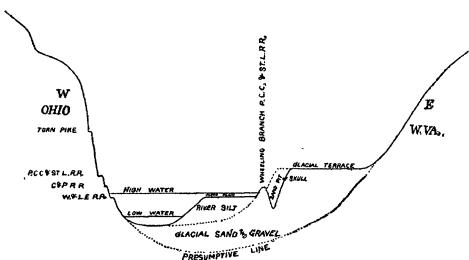
"The Glacial terrace in the vicinity of Steubenville, Ohio, consists of gravel and sand in varying proportions from fine sand up to small boulders of about six inches in diameter, the large proportion of the material, however, is from the size of wheat grains down. The material is partly derived from local rocks, but a large percentage, varying in different localities, is from the granitic and related material transported from the north of the lakes, the character of the latter being so distinctive as to convince geologists of its derivation as indicated above, and that it came from the grit of the glacier once covering the northern part of the continent. The material has been transported by water action from the farthest limit southward of the glacier, whose nearest approach to the locality under consideration was at Lisbon in Columbiana County, twenty-five miles northward.

"The terrace material is supposed to reach in places over one hundred feet in depth below high water of the Ohio River, and rises in the vicinity in places over seventy feet above low-water mark, or about thirty-five or forty feet above high water.

"The skull of the musk ox exhibited at the Pittsburgh meeting of the American Association for the Advancement of Science was found in the glacial terrace above described, the locality being on the West Virginia side of the Ohio, opposite and over one mile below Steubenville, Ohio, in the sand pit of the Steubenville Sand Co. on the Thomas Mahan farm, Brook Co., West Va., and at the east side of the Wheeling Branch of the P. C. C. & St. L. R. R. (Panhandle).

"The find consists of the major part of the skull, with brain cavity and portions of horn cores, and appears to be that of a musk ox. The skull was found by a laborer in the pit on the face of the talus slope, and therefore out of its original position. The contents of the brain and other cavities were the same as the terrace in general. The skull was first seen in the face of the slope of the pit above the level of the railroad, which is several feet above the highest level the river has ever

reached since the vicinity has been inhabited by the whites. As any movement of the skull must necessarily have been downward, its original position before the sand was disturbed must have been well above high water, although the preservation of the skull must be held to indicate considerable covering, as it has lain for thousands of years in the terrace. The surface of the terrace is covered with a layer of clayey material that would be quite an element in the preservation of the skull. Near the position of the skull and under similar circumstances has since been found the nearly complete shoulder blade of a mammoth, which is now in my possession. The original position of the skull and shoulder blade as to geological horizon, was probably somewhat lower than that of the knife presented at the Springfield meeting of the American Association for the Advancement of Science, and found five miles below and on the opposite side of the Ohio River, but in the same glacial deposit. The accompanying sketch indicates the approximate cross-section of the Ohio River valley at the point under consideration."



I have examined with some care this skull, which, through the kindness of Mr. Huston, is now in the loan collection of this Museum. Only the posterior portion of it is preserved, and this appears to have pertained to a not very old though fully adult individual, as is evidenced by the nature of the sutures of the inferior region of the cranium. All that region anterior to the orbits is wanting. The zygomata and inferior processes (pterygoids, postglenoids, paroccipitals) are likewise broken away. The rounded and polished nature of many of the surfaces indicates that it was transported for some distance before becoming

finally imbedded in the terrace from which it was recovered after the manner detailed by Mr. Huston. The bones of the cranium are exceptionally heavy and massive, indicating that the skull pertained to an adult male. The frontoparietal surface is gently but regularly concave, the depth of the concavity being 18 mm. This surface is likewise very rugose. The horn cores are directed abruptly downward and a little inward distally, in so far as they are preserved. The extremities of both horn cores are wanting. The expanse of the horn cores equals but does not exceed that of the orbits. There are rather large frontal sinuses. These, as well as the various foramina, contain a considerable number of pebbles, nearly all of which are of local origin. Among them are two rather large fragments of coal. The character of the enclosed pebbles would seem to indicate that the specimen had not come much in contact with glacial detritus from the north.

The characters of the skull are such that I have no hesitancy in referring it to *Ovibos cavifrons* Leidy, first described by Dekay in 1828 as *Bos pallassi* in the *Annals* of the Lyceum of Natural History of New York. The chief interest attached to the present specimen comes from the additional evidence it affords as to the faunal changes brought about over this region during the glacial period. The remains of this animal have now been authentically reported from Fort Gibson, I. T.; St. Louis, New Madrid and Benton Co., Mo.; Trumbull Co., Ohio; Big Bone Lick, Ky.; from two different localities in Pennsylvania; and from Council Bluffs, Iowa and West Virginia. In every instance these remains have been recovered either directly from glacial deposits or from deposits that have been correlated with some stage of the glacial period. Since there would seem no good reason for assuming that the musk ox at that time preferred climatic conditions very different from those with which they are at present surrounded, the reasonable inference would seem to be that with the advancing ice they moved southward until their range reached an extreme limit averaging a few degrees, perhaps

three or four, beyond the southern limit of the ice.

J. B. HATCHER.

CARNEGIE MUSEUM.

EXCEPTIONS TO MENDEL'S LAW.

DE VRIES, Correns, and some other writers have called attention to a number of apparently important exceptions to Mendel's law. In order to show the relation of these exceptions to the law, the law itself may be illustrated as follows: A and B are two plants, each of which is self fertile and which may be hybridized. Regarding any single respect in which these two plants differ, the resulting hybrid is a mono-hybrid. We will assume that the character B is recessive in the hybrid, representing the character by a small letter in cases where it is latent. The following diagram shows the results of hybridization, as far as the second generation.

		Types of plant	
		Pollen.	Ovules.
Male parent	A	A	A
	Ab	A × B	Ab
	(Hybrid)	B × A	Ab
Female parent	B	B	B

This diagram shows that from the two kinds of pollen and two kinds of ovules produced by the hybrid plant Ab we get four fertilizations: A × A, which gives plants of the type of the parent A; B × B, which gives plants like the parent B; A × B and B × A, which give again the hybrid Ab.

It should also be stated that since each of these four crosses will occur an equal number of times according to the law of probabilities, the type A will constitute one fourth of the second generation, B one fourth, and Ab one half.

Mendel's law, as first stated independently in this country (Bul. 115, Off. Ex. Sta., p. 93) and essentially as stated by himself, is as follows: In the second and later generations of a hybrid there occur all the possible combinations of the characters of the parents, and in definite proportions.

But hybrids have been found in which this seems not to be the case. The explanation of a number of these is here offered. Millardet, De Vries, Correns and others report cases of